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FOREIGN TECHNOLOGY DIVISION

SCIENTISTS ANSWERS READERS

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SCIENTISTS ANSWERS READERS

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Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere. When written as ë in Russian, transliterate as yë or ë. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

GREEK ALPHABET

Alpha	A	α	*α*	Nu	N	ν	
Beta	B	β		Xi	Ξ	ξ	
Gamma	Γ	γ		Omicron	O	ο	
Delta	Δ	δ		Pi	Π	π	
Epsilon	E	ε	*ϵ*	Rho	P	ρ	*ϱ*
Zeta	Z	ζ		Sigma	Σ	σ	*ς*
Eta	H	η		Tau	T	τ	
Theta	Θ	θ	*ϑ*	Upsilon	T	υ	
Iota	I	ι		Phi	Φ	φ	*ϕ*
Kappa	K	*ϰ*	κ	Chi	X	χ	
Lambda	Λ	λ		Psi	Ψ	ψ	
Mu	M	μ		Omega	Ω	ω	

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English
sin	sin
cos	cos
tg	tan
ctg	cot
sec	sec
cosec	csc
sh	sinh
ch	cosh
th	tanh
cth	coth
sch	sech
csch	csch
arc sin	$\sin^{-1}$
arc cos	$\cos^{-1}$
arc tg	$\tan^{-1}$
arc ctg	$\cot^{-1}$
arc sec	$\sec^{-1}$
arc cosec	$\csc^{-1}$
arc sh	$\sinh^{-1}$
arc ch	$\cosh^{-1}$
arc th	$\tanh^{-1}$
arc cth	$\coth^{-1}$
arc sch	sech^{-1}
arc csch	csch^{-1}
rot	curl
lg	log

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SCIENTISTS ANSWER READERS

THE THOUSAND AND ONE USES OF AN EXPLOSION

"Please tell about the peaceful uses of an explosion," writes engineer V. Nogayev from Naro-Fominsk. He is answered by the laboratory director at the Institute of Hydrodynamics of the Siberian branch of the Academy of Sciences USSR, A. A. Deribas -- secretary of the Scientific Council on National Economic Use of Explosions.

For a long time an explosion was known to have only the ability to destroy. Since early times its truly enormous destructive power did have practical application -- in mining and in construction. But an explosion performed its role of destroyer very crudely. A chaotic heap of debris, messily scattered soil -- this is how the fruits of its usual work are yielded. Both miners and builders long wondered whether it was possible to blow up rock or soil in such a way that, instead of breaking up in various directions, it would fly in a compact mass to a predetermined point.

This problem has been solved by Academician M. A. Lavrent'yev and his students V. M. Kuznetsov and E. M. Sher. It is known that an explosion develops tremendous pressures on the order of hundreds

of thousands of atmospheres. Under such conditions at the moment of explosion the solid matter surrounding the charge degenerates, as it were, and behaves like a fluid. Consequently, to calculate the movement of soil at the instant of explosion it is possible to use the powerful mathematical apparatus of hydrodynamics. The researches of M. A. Lavrent'yev and his students have shown that it is possible to calculate mathematically and prepare a charge which will cause as much as 90% of the upthrown dirt to fly in a predetermined direction. True, if hard rock has to be blasted, the calculations become more complicated, but directed ejection is possible even in this case. Of course, a charge which throws the dirt to a predetermined spot has a rather complex configuration and requires somewhat more explosive material than usual, but all costs are repaid by the efficiency of the controlled ejection.

For several years now the Institute of Hydrodynamics of the Siberian branch of the Academy of Sciences USSR, in collaboration with the Soyuzvzryvprom trust [Trust for Drilling and Blasting Operations of the Main Administration for Special Types of Construction and Installation], has been putting the elaborated theory of the controlled explosion into practice. The explosion digs ditches, builds embankments, and cuts channels.

Comparatively recently, explosions had another, but no less important, job -- welding. True, it is performed in a rather unusual way. With its remarkable power an explosion "throws" one of the pieces to be welded against another with a speed of several hundred meters per second. The pressure produced by the impact of the pieces reaches several hundred atmospheres. The sudden plastic

deformations of the metal produce a sharp rise in its temperature. The unusual pressure and temperature conditions in this case, too, cause solid matter for a few millionths of a second to also acquire the properties of a fluid. Just as meeting streams of water flow together into one, so do the surface layers of the pieces to be welded merge on impact and unite with each other. The bond thus obtained is a strong one. If one now tries to break the material, breakage, as a rule, occurs not along the weld, but in the weaker metal of the welded pair.

The explosion method of welding, which was worked out by Institute of Hydrodynamics staff members V. M. Kudinov, F. I. Matveyenkov, and A. A. Deribas, is very promising. It makes it possible, for example, to weld metals which before could not be joined by any other means. A number of the nation's metallurgical plants have begun to use explosion welding industrially. For this the first test batches of various bimetals have already been prepared.

Here is yet another kind of work on the use of explosions for peaceful purposes. It began with a meeting between staff members of our Institute of Hydrodynamics and workers of the Novosibirsk railroad switch plant. It was about the point on the switch frog -- the most critical and rapidly-wearing part of railroad switches. In the course of operation the point undergoes crushing, and when its height is reduced by 6-7 millimeters, according to existing regulations, it must be replaced. It is curious, however, that high-manganese steel, from which points are manufactured, becomes stronger when crushed. A point reaches its maximum hardness (2-2.5 times initial hardness) if it is reduced by just three millimeters through

crushing. The workers of the Novosibirsk switch plant expressed a most intriguing idea: even before putting points into operation, strengthen them by crushing and thereby increase their life.

Experiments and calculations carried out at the Institute of Hydrodynamics led specialists to conclude that the best way of strengthening metal was the explosion method. On the one hand, it is technologically simple and does not require costly equipment -- explosive material is laid out on the surface of the metal and detonated. On the other hand, it gives good results: the original hardness of the surface layer of a metal can be doubled, and the depth of the zone of strengthening is measured in tens of millimeters -- a figure unattainable by other means of strengthening.

Not long ago service tests were performed on a large batch of new points. The results permit one to anticipate a substantial economic impact. An entire section of the switch plant is now being equipped to strengthen points by the explosion method. Thus the work will have a mass-production, rather than an experimental, character.

The idea of strengthening metal by means of explosions has become popular. This method is used to reinforce the jaws of ore crushers, the shoes of caterpillar tracks, and other parts.

Many other peaceful uses for explosions have appeared recently. Explosive forming operations have been carried on for some time. One of the leading roles in the development and perfecting of this method belongs to the Khar'kov Aircraft Institute. The problem of seismic prospecting with the help of explosions is being solved at the Scientific Research Institute of Geophysics. A blast wave

"X-rays" the earth's crust, somewhat like the way in which the human body is examined with X-rays. This "X-raying" helps to discover deposits of minerals.

A group of members of the Institute of Geophysics of the Siberian branch of the Academy of Sciences USSR headed by Doctor of Chemistry S. S. Batsanov, in collaboration with members of the Institute of Hydrodynamics, has for a number of years studied matter subjected to the action of strong explosive waves. It has been found that an explosion causes interesting and occasionally unexpected changes in the atomic and electron structure of matter. It is possible that with the aid of explosions electrons can be forced into atomic nuclei. This opens up intriguing prospects for obtaining new forms of matter with valuable properties.

This article has discussed several new studies at the Institute of Hydrodynamics of the Siberian branch of the Academy of Sciences USSR which have been worked on by the Scientific Council on National Economic Use of Explosions. Important and fruitful research into the use of explosions is being carried on as well at numerous scientific institutes in Moscow, Leningrad, Kiev, and other cities of the country.

Thus, work on obtaining superhigh pressures with explosions is being successfully conducted at the Institute of Chemical Physics of the Academy of Sciences USSR. Very interesting research on the seismic effect of explosions is taking place at the Institute of Lithosphere Physics of the Academy of Sciences USSR. The mechanism of the effect of explosions in the ground is being thoroughly studied at the Institute of Mechanics of MGU [Moscow State University]

and in a number of other organizations.

However, many other important problems of the theory of explosions remain unsolved. The answers to them will reveal new capabilities of explosions.

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